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Meyers**

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(54) **RELEASE MECHANISM FOR A ROTARY
TOOL**

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(52) **U.S. Cl.**
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(2015.01); *Y10T 279/17307* (2015.01); *Y10T*
279/17341 (2015.01); *Y10T 279/17529*
(2015.01); *Y10T 279/18* (2015.01); *Y10T*
279/32 (2015.01)

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USPC 279/43.4, 35, 51, 106, 140, 19.1, 43.2,
279/46.3; 403/367, 368, 374.1, 374.2,
403/409.1
See application file for complete search history.

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Primary Examiner — Eric A Gates

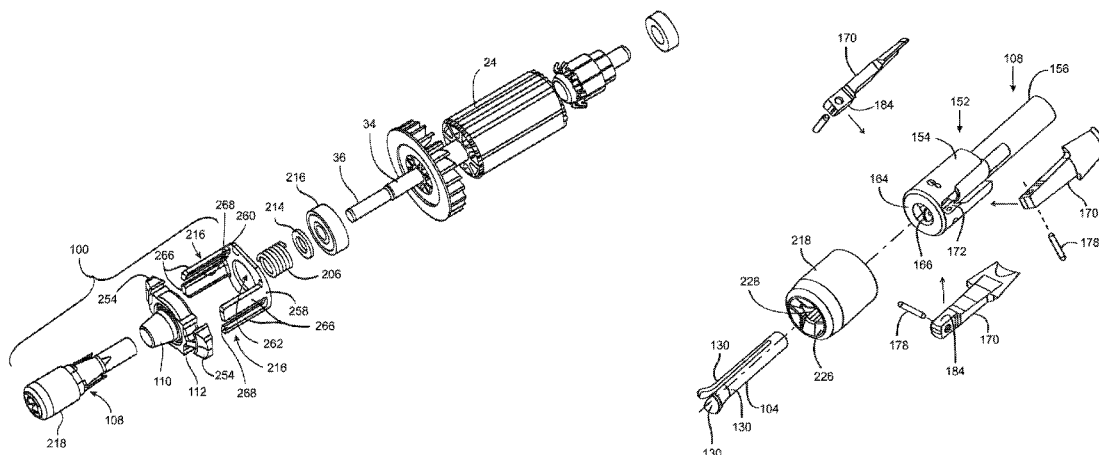
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(57) **ABSTRACT**

A rotary tool includes a housing defining at least one slot and
a motor including an output shaft supported within the hous-
ing. A collet chuck is coupled to the output shaft that is
configured to slidably receive a collet. The collet chuck
includes at least one lever arm configured to apply a clamping
force to the collet. A wedge is configured to move into and out
of engagement with the at least one lever arm to generate the
clamping force. A bearing is attached to the wedge, and a
yoke member is attached to the bearing. The yoke member
includes at least one lever structure that projects outwardly
from the yoke member through the slot in the housing.

18 Claims, 14 Drawing Sheets



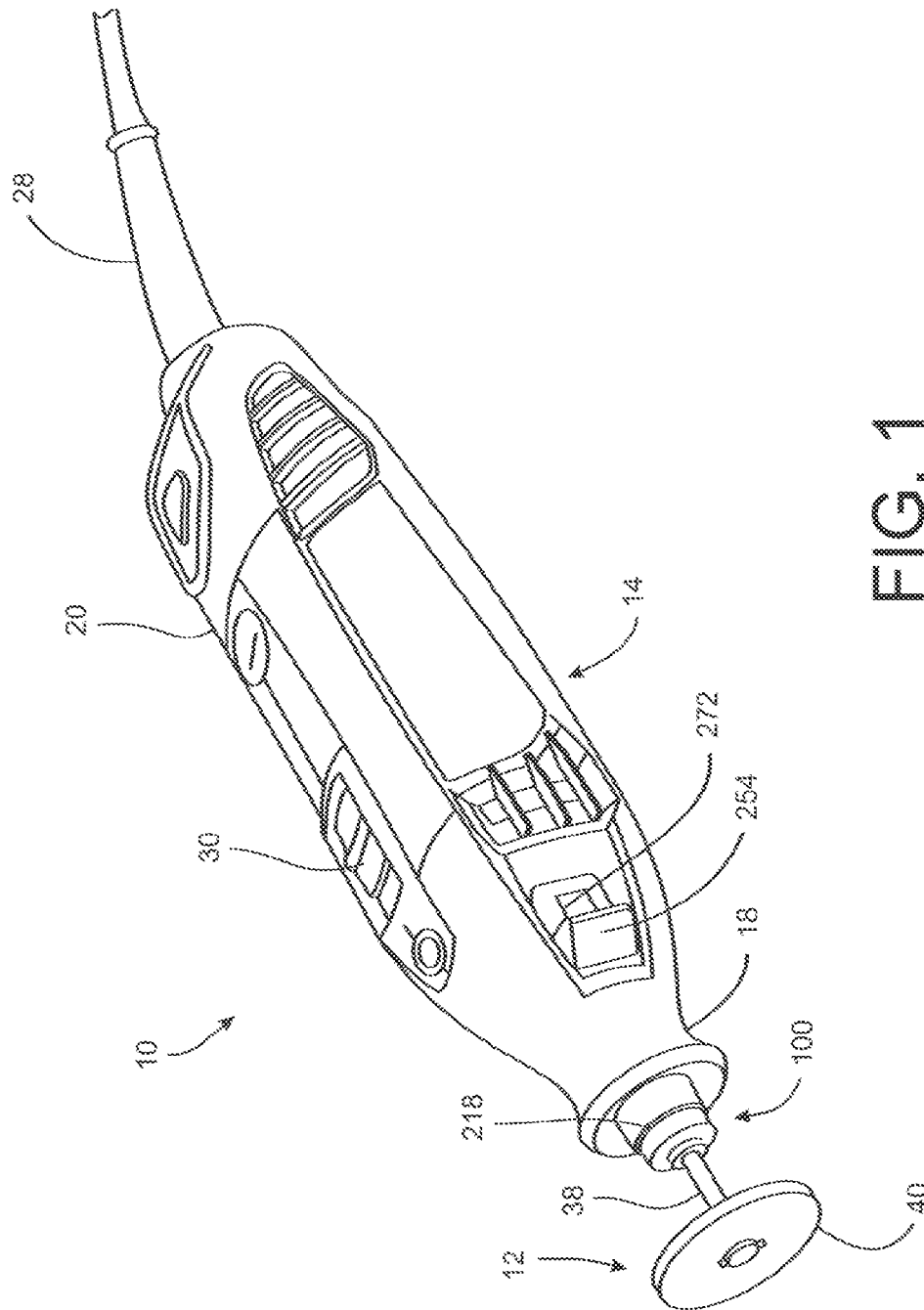


FIG. 1

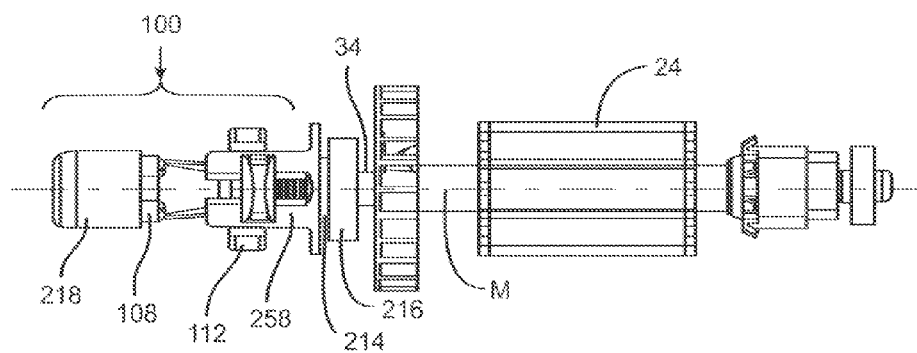


FIG. 2

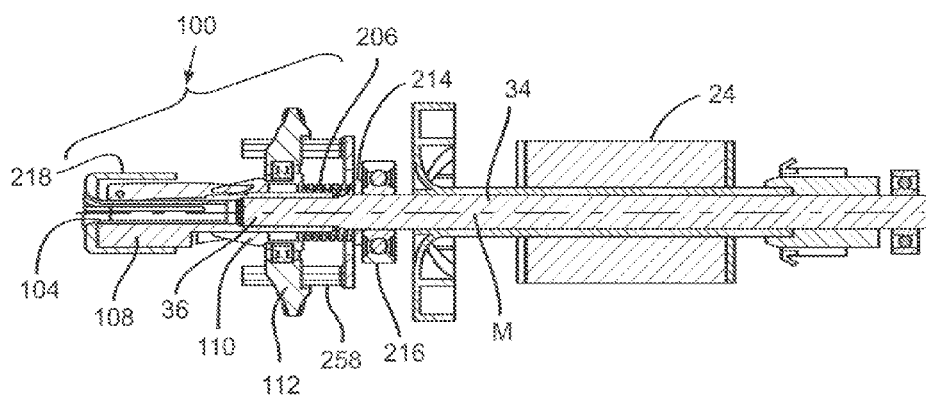
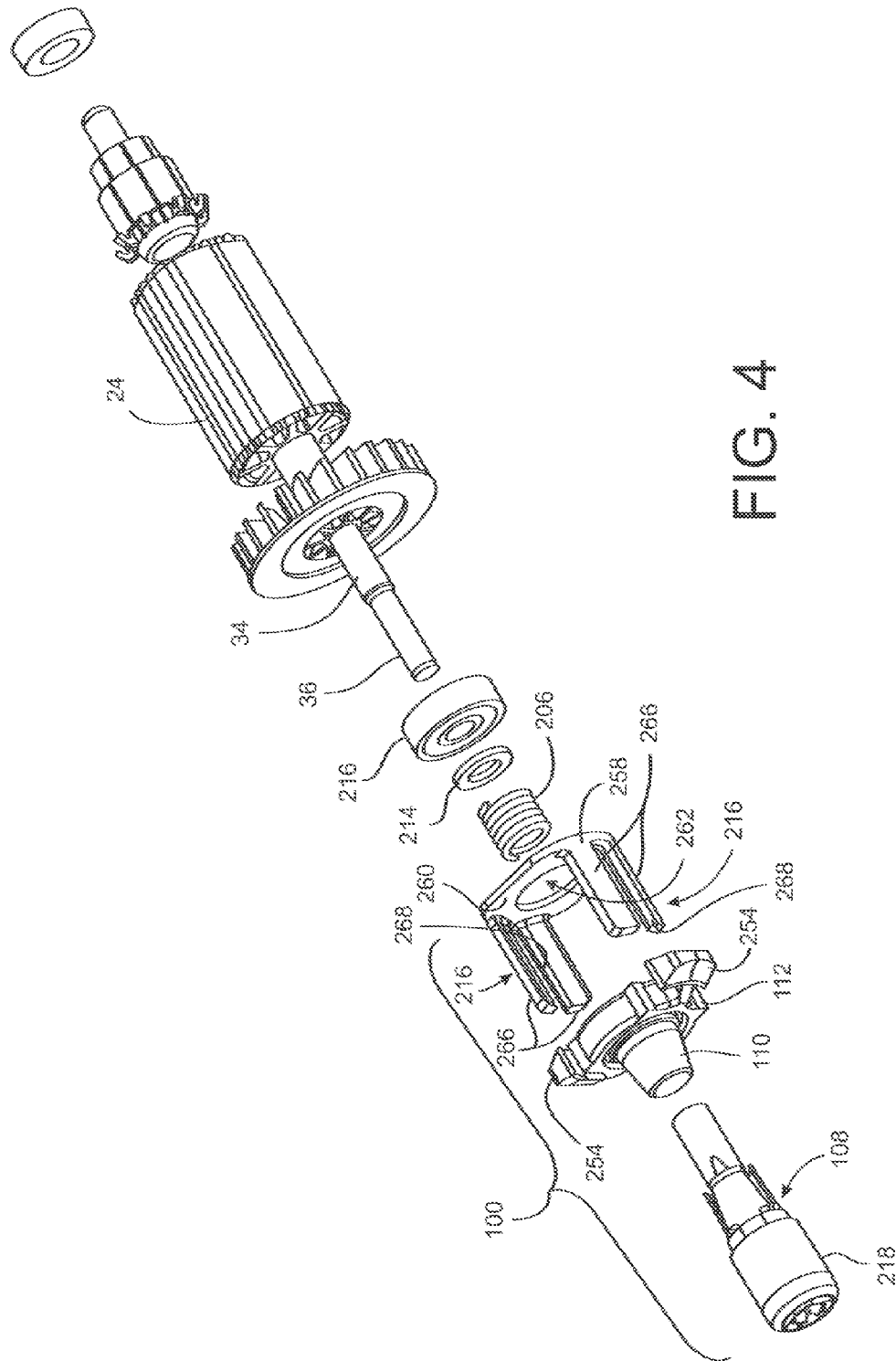


FIG. 3



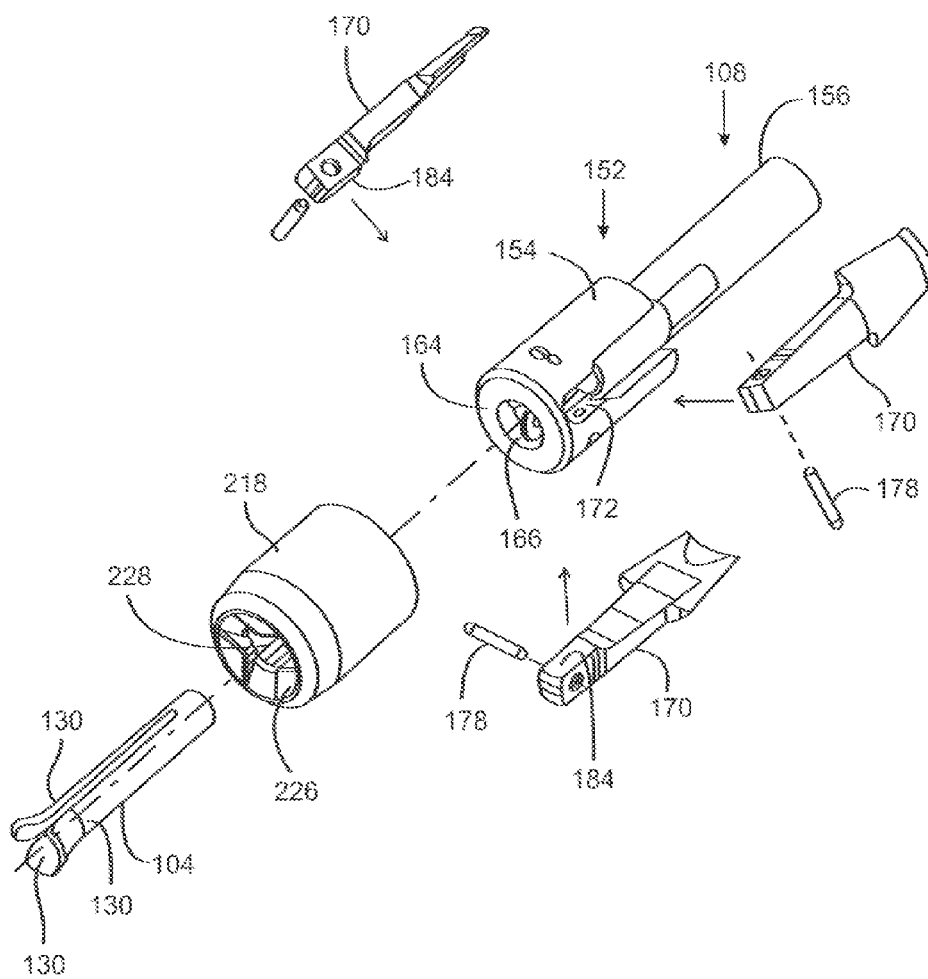


FIG. 5

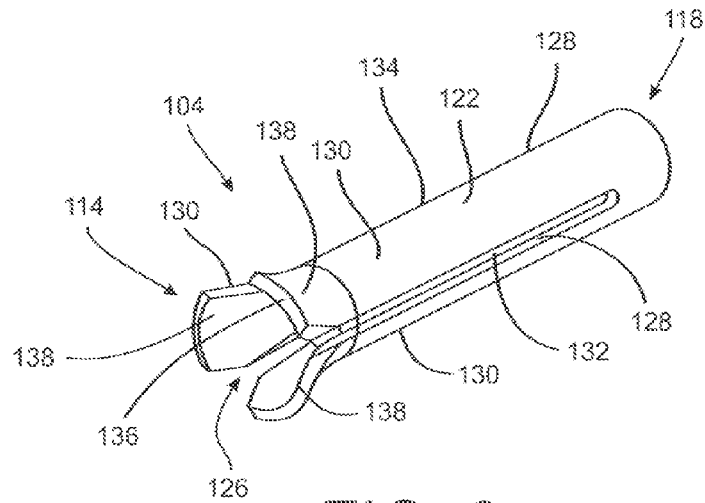


FIG. 6

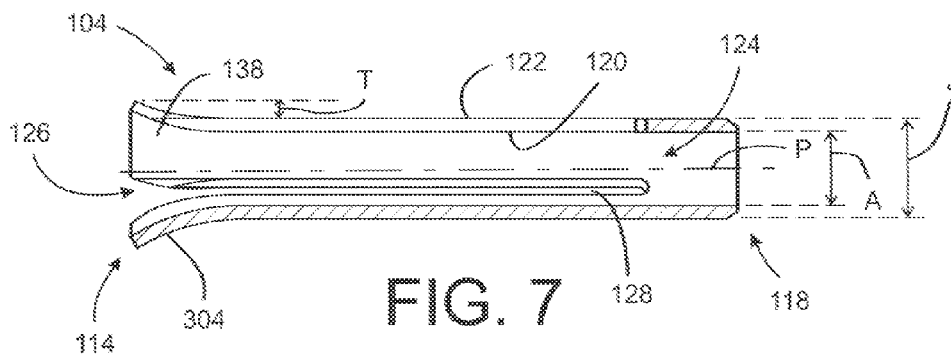


FIG. 7

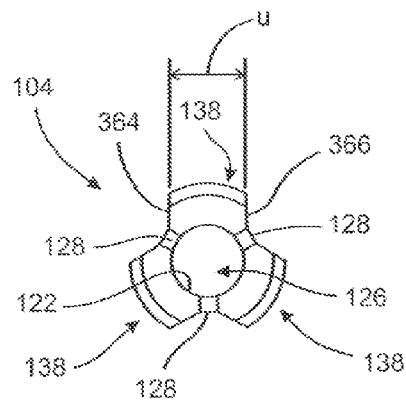


FIG. 8

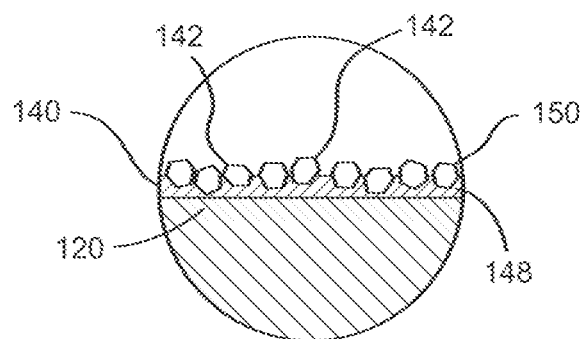


FIG. 9

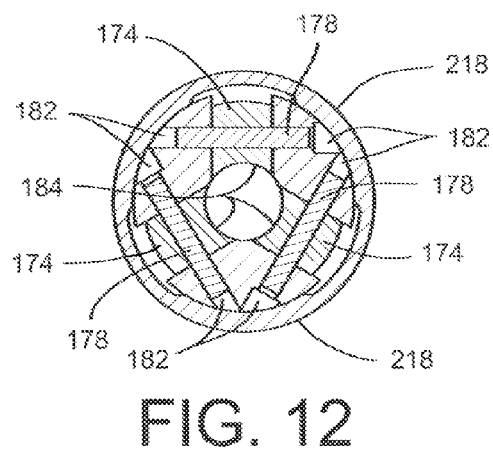


FIG. 14

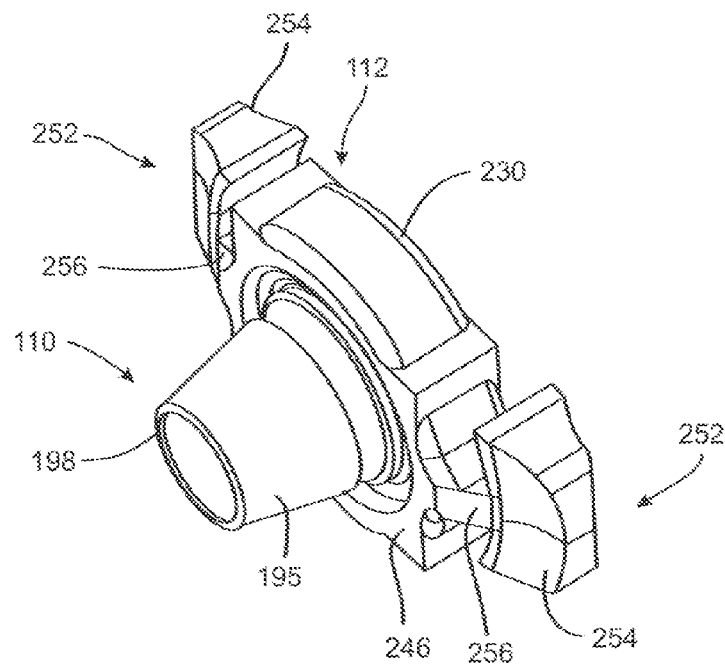


FIG. 15

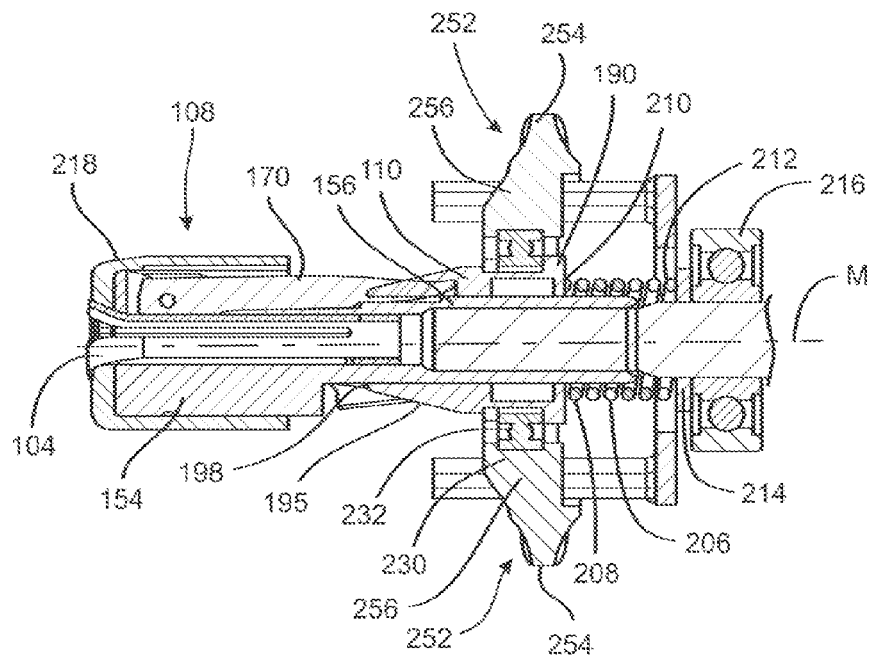


FIG. 16

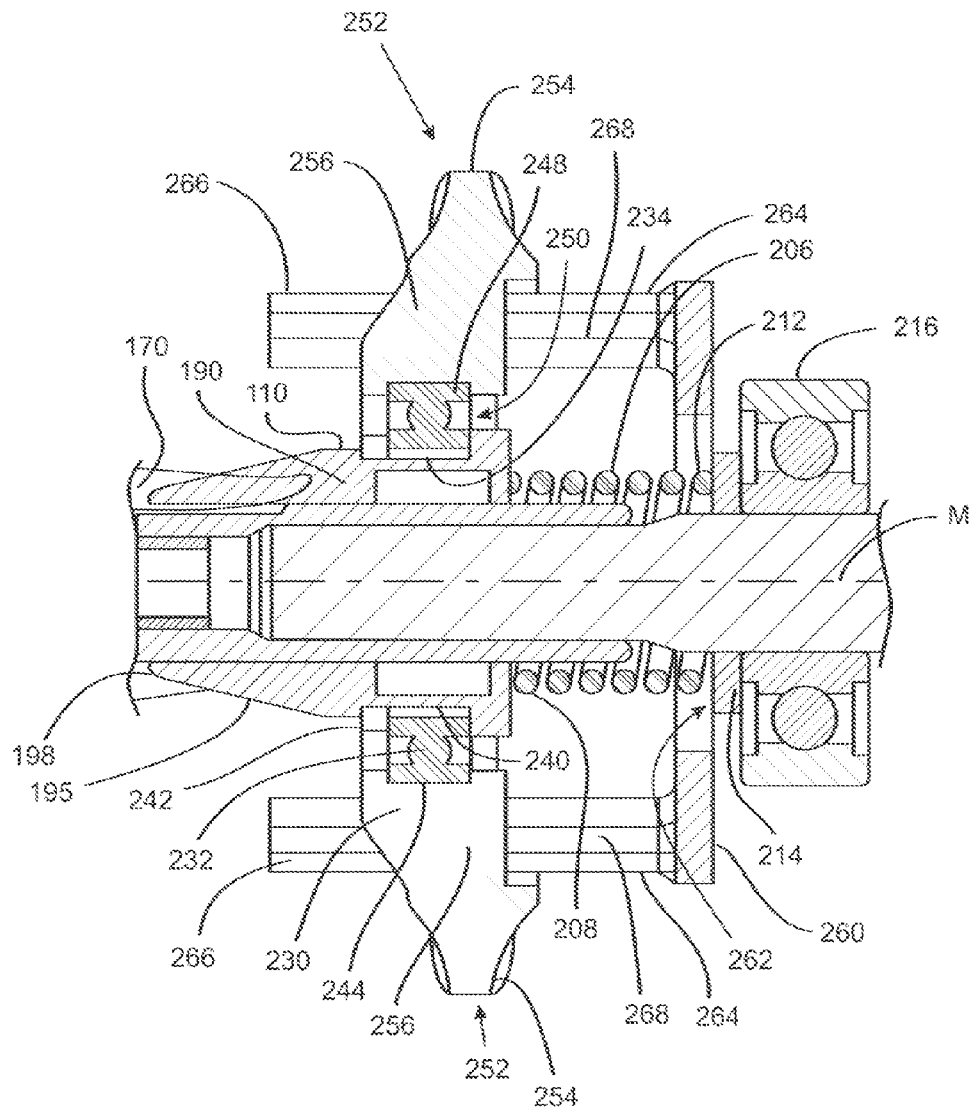


FIG. 17

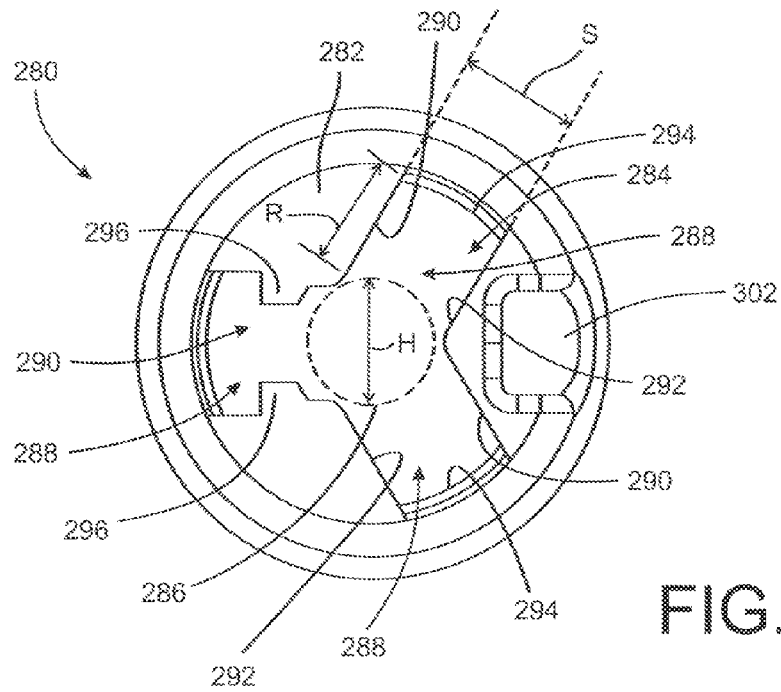


FIG. 18

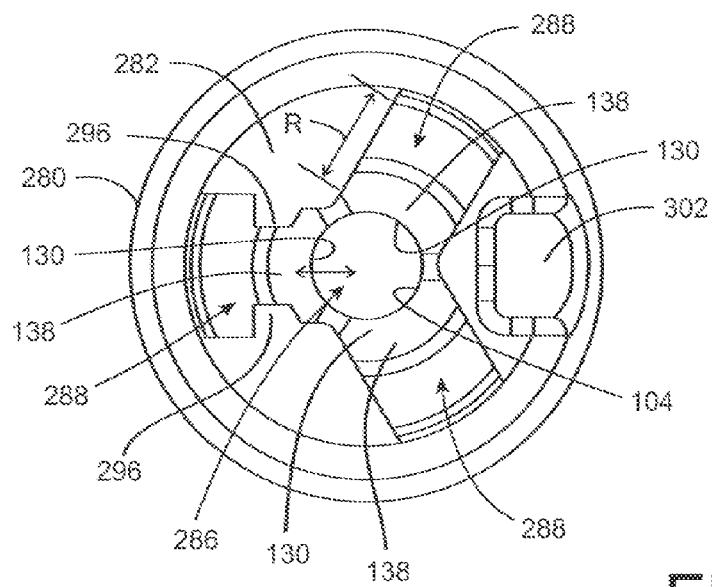


FIG. 19

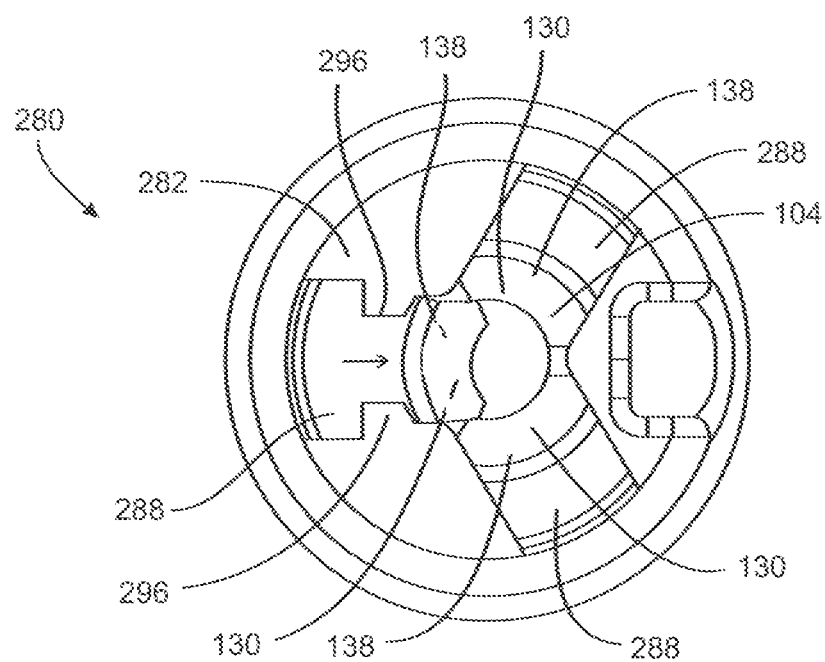


FIG. 20

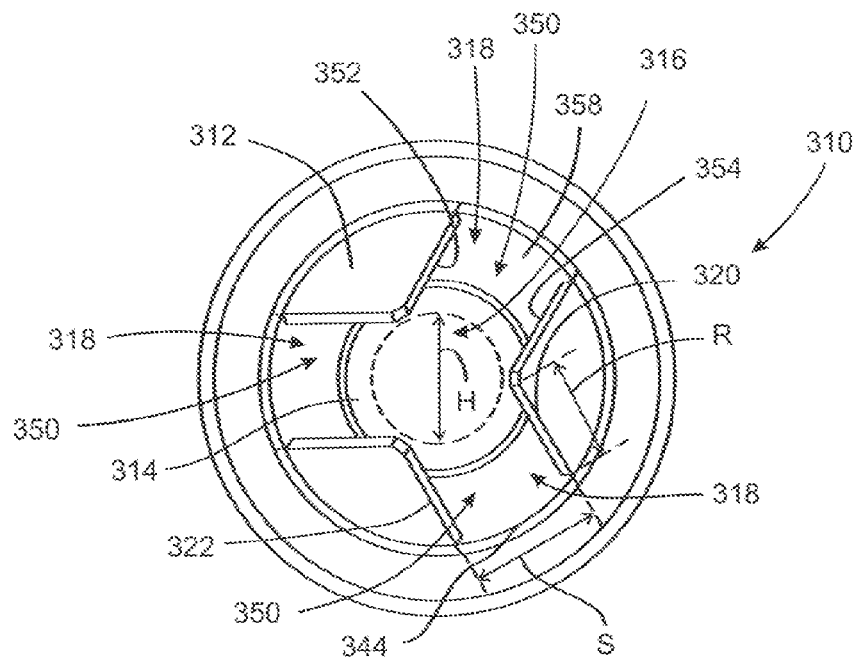


FIG. 21

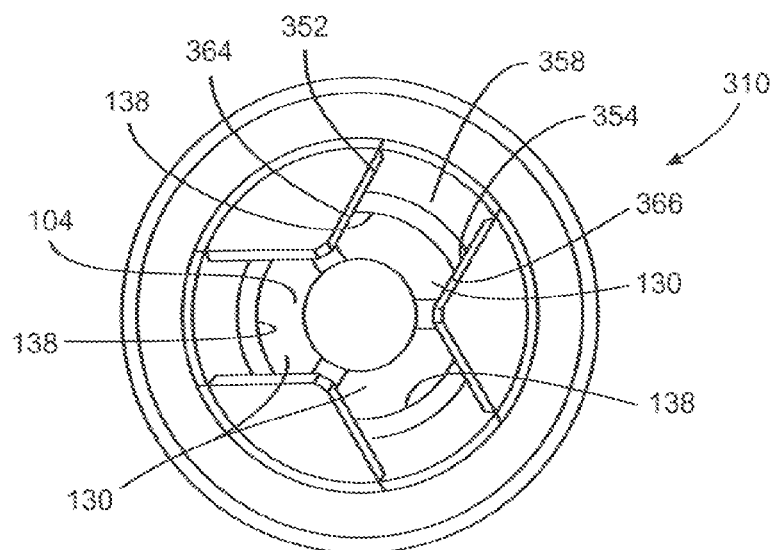


FIG. 22

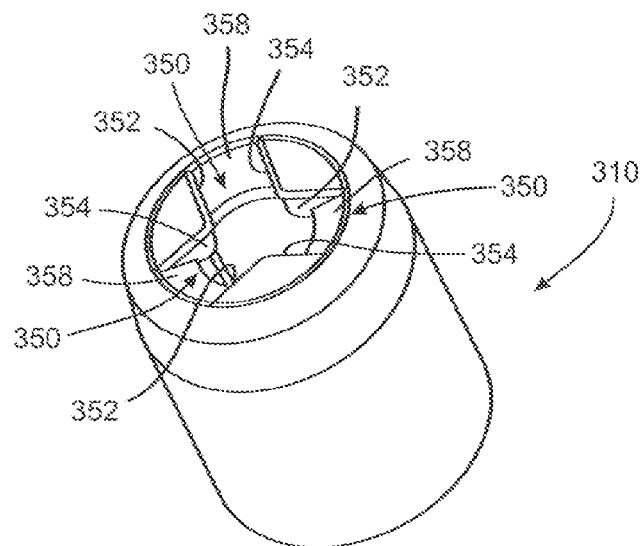


FIG. 23

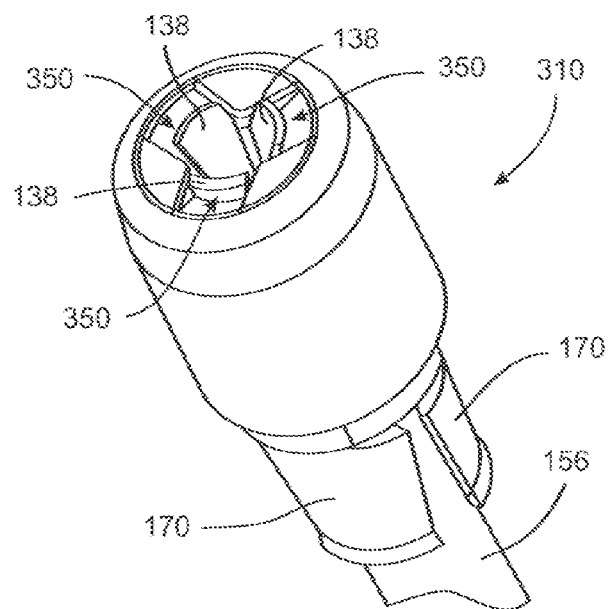


FIG. 24

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RELEASE MECHANISM FOR A ROTARY TOOL

TECHNICAL FIELD

The present disclosure relates generally to rotary power tools and more particularly to accessory tool attachment systems for use with rotary power tools.

BACKGROUND

In general, rotary power tools are light-weight, handheld power tools capable of being equipped with a variety of accessory tools and attachments, such as cutting blades, sanding discs, grinding tools, and many others. These types of tools typically include a generally cylindrically-shaped main body that serves as an enclosure for an electric motor as well as a hand grip for the tool. The electric motor drives an output shaft to rotate at high speeds. The output shaft is equipped with an accessory attachment system that enables various accessory tools to be releasably secured to the power tool.

Accessory attachment systems for rotary power tools typically include a collet configured to grip the shank of an accessory tool. When attached to the rotary tool, the collet holds the shank of the accessory tool in line with the axis of the output shaft so the accessory tool can be driven to rotate about the axis by the motor. As the output shaft is rotated, an accessory tool is driven to perform a particular function, such as sanding, grinding, or cutting, depending on the configuration of the accessory tool.

The collet is usually attached to the output shaft of the motor of the rotary tool by a retention mechanism, such as a collet nut or collet chuck. A collet nut is installed over the collet and threaded into the end of the output shaft. The collet nut has a tapered bore so that as the collet nut is threaded onto the output shaft, the interior surfaces of the collet nut press the collet against the shank of the accessory tool thus securing the collet and accessory tool to the output shaft of the motor. While this method is effective for securing accessory tools to the rotary power tool, threading the collet nut onto and off of the output shaft of the motor can be time consuming and inconvenient and may require the use of separate tools for turning the collet nut.

As an alternative to threadedly attaching a collet to the output shaft, some previously known systems have been equipped with quick change mechanisms that enable accessory tools to be installed and removed from the collet without having to thread a collet nut onto and off of the output shaft. Quick change mechanisms typically include a collet chuck that is configured to hold the collet and have a mechanism for clamping down on the collet to cause the collet to grip onto the shank of an accessory tool. The clamping mechanism is manipulated by ribbed sleeve that can be grasped by the user. The ribbed cylinder, however, can be difficult for a user to hold onto and does not readily provide a visual indication as to the state of the clamping force applied to the collet.

In some quick change mechanisms, the collet is provided as a separate, removable component. Numerous factors must be taken into consideration in utilizing a removable collet. For example, the collet should be retained within the collet chuck while the tool is being operated and while the shank of an accessory tool is being inserted into and removed from the collet. The removable collet should also be capable of adequately gripping the shank of an accessory tool during use. In addition, care must be taken to ensure that the collet is oriented properly within the collet chuck so that the clamping mechanism can work properly.

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There is a need for a rotary tool system having a quick change assembly that enables accessory tools to be easily installed and removed from the collet of the rotary tool and that can be easily accessed and manipulated by a user of the tool. There is also a need for a quick change assembly for a rotary tool that has a removable collet with enhanced gripping capability. In addition, there is a need for a quick change assembly that enables a removable collet to be releasably retained and/or properly oriented within the quick change mechanism without requiring an expensive or complex mechanism.

DRAWINGS

FIG. 1 is a perspective view of an embodiment of a rotary tool according to the present disclosure.

FIG. 2 is an elevation view of the internal components of the rotary tool of FIG. 1.

FIG. 3 is a cross-sectional view of the internal components of the rotary tool depicted in FIG. 2.

FIG. 4 is an exploded view of the internal components of the rotary tool depicted in FIG. 2.

FIG. 5 is an exploded view of the collet chuck assembly of the rotary tool of FIG. 1.

FIG. 6 is a perspective view of the collet of the collet chuck assembly of FIG. 5.

FIG. 7 is a cross-sectional view of the collet of FIG. 6.

FIG. 8 is an end view of the collet of FIG. 5.

FIG. 9 is a partial fragmentary view of the collet showing an abrasive coating on the inner surface of a collet.

FIG. 10 is a cross-sectional view of the collet chuck of FIG. 5.

FIG. 11 is a cross-sectional view of the main body of the collet chuck of FIG. 10.

FIG. 12 is a cross sectional view of the collet chuck of FIG. 5 taken along lines 12-12.

FIG. 13 is a perspective view of the wedge-shaped ring of the quick change assembly of the rotary tool of FIG. 1.

FIG. 14 is cross-sectional view of the wedge-shaped ring of FIG. 13.

FIG. 15 is a perspective view of the release mechanism mounted onto the wedge-shaped ring of FIG. 13.

FIG. 16 is a cross-sectional view showing the collet chuck assembly of FIG. 10 the wedge-shaped ring of FIG. 13, and the release mechanism of FIG. 15.

FIG. 17 is a cross-sectional view of the wedge-shaped ring and release mechanism of FIG. 16 shown in greater detail.

FIG. 18 is a front view of an embodiment of a nose cap configured to releasably retain the collet of FIG. 6 within the collet chuck assembly of FIG. 10.

FIG. 19 is a front view of the nose cap of FIG. 18 with the collet of FIG. 6 retained therein.

FIG. 20 is a front view of the nose cap of FIG. 18 with the collet of FIG. 6 positioned therein with a segment of the collet deflected inwardly to enable insertion/removal of the collet.

FIG. 21 is a front view of an embodiment of a nose cap configured to place the collet at a predetermined orientation with respect to the collet chuck.

FIG. 22 is a front view of the nose cap of FIG. 21 with the collet of FIG. 6 positioned therein.

FIG. 23 is a perspective view of the nose cap of FIG. 21.

FIG. 24 is a perspective view of the nose cap of FIG. 21 with the collet positioned therein.

DESCRIPTION

For the purposes of promoting an understanding of the principles of the disclosure, reference will now be made to the

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embodiments illustrated in the drawings and described in the following written specification. It is understood that no limitation to the scope of the disclosure is thereby intended. It is further understood that the present disclosure includes any alterations and modifications to the illustrated embodiments and includes further applications of the principles of the disclosure as would normally occur to one of ordinary skill in the art to which this disclosure pertains.

In accordance with one embodiment, a rotary tool comprises a housing defining at least one slot, and a motor including an output shaft supported within the housing. A collet chuck is coupled to the output shaft. The collet chuck includes a main body defining a collet receiving passage configured to slidably receive a collet. The collet chuck includes at least one lever arm pivotably attached to the main body and configured to apply a clamping force to the collet when the collet is received in the collet receiving passage. A wedge is configured to move into engagement with the at least one lever arm to generate the clamping force and to move out of engagement with the at least one lever arm to remove the clamping force. A bearing is attached to the wedge, and a yoke member is attached to the bearing such that the yoke member and the wedge are rotatable with respect to each other. The yoke member includes at least one lever structure that projects outwardly from the yoke member through the slot in the housing. The lever structure is movable between a first position and a second position. The wedge is moved into engagement with the at least one lever arm when the lever structure is moved to the first position, and the wedge is moved out of engagement with the at least one lever arm when the lever structure is moved to the second position.

In accordance with another embodiment, a quick change assembly for a rotary tool comprises a collet chuck configured to couple to the output shaft of a motor of a rotary tool. The collet chuck has a main body defining a collet receiving passage configured to slidably receive a collet. The collet chuck includes at least one lever arm pivotably attached to the main body and configured to apply a clamping force to the collet when the collet is received in the collet receiving passage. A wedge is configured to move into engagement with the at least one lever arm to generate the clamping force and to move out of engagement with the at least one lever arm to remove the clamping force. A bearing is attached to the wedge, and a yoke member is attached to the bearing such that the yoke member and the wedge are rotatable with respect to each other. The yoke member includes at least one lever structure that projects outwardly from the yoke member through the slot in the housing. The lever structure is movable between a first position and a second position. The wedge is moved into engagement with the at least one lever arm when the lever structure is moved to the first position, and the wedge is moved out of engagement with the at least one lever arm when the lever structure is moved to the second position.

In accordance with yet another embodiment, a rotary tool includes an accessory tool attachment system having a leading portion and a trailing portion. A user interface system is attached to the attachment system. The user interface system includes a release mechanism defining a yoke member configured to move axially between a first position and a second position and a bearing configured to decouple the yoke member from rotational movement of the accessory tool attachment system.

Turning to the figures, FIG. 1 illustrates a rotary tool 10 of the present disclosure. The rotary tool 10 includes an accessory tool attachment system 100, referred to herein as a quick change assembly, that enables accessory tools, such as accessory tool 12, to be quickly installed and removed from the

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rotary tool 10. Referring to FIG. 1, the rotary tool 10 includes a generally cylindrically shaped housing 14 constructed of a rigid material such as plastic, metal, or composite materials such as a fiber reinforced polymer. The housing 14 includes a nose portion 18 and a main body portion 20. The main body portion 20 serves as the handle for the tool 10 and encloses a motor 24 (FIG. 2). In one embodiment, the motor 24 comprises an electric motor configured to receive power from an AC outlet (not shown) via a power cord 28. Alternatively, electric power for the motor 24 may be received from a rechargeable battery (not shown) connected at the base of the main body portion 20. As an alternative to electric power, the rotary tool 10 may be pneumatically or hydraulically powered. Power to the motor is controlled by a power switch 30 provided on the handle portion 20 of the housing 14.

As depicted in FIGS. 2-4, the motor 24 has an output shaft 34 that is configured to be rotated by the motor about a motor axis M. The quick change assembly 100 is attached to the distal end portion 36 of the output shaft 34. The quick change assembly 100 is configured to releasably retain any one of a plurality of different accessory tools, or tool bits, to the output shaft of the rotary tool 10. Accessory tools, including accessory tool 12, include a shank 38 and a working portion 40 (FIG. 1). The shank 38 is generally cylindrical and has a predetermined diameter, such as, for example, one quarter ($\frac{1}{4}$) of an inch, three sixteenths ($\frac{3}{16}$) of an inch, one eighth ($\frac{1}{8}$) of an inch, four to six (4-6) millimeters and/or the like. The working portion 40 has a configuration adapted to perform a specific type of task or tasks, such as, for example, milling, drilling, cutting, grinding, and the like.

Referring to FIGS. 2-5, the quick change assembly 100 includes a collet 104, a collet chuck 108, a wedge-shaped ring 110, and a release mechanism 112. As depicted in FIGS. 6-8, the collet 104 comprises a generally cylindrical body having a leading end portion 114, a trailing end portion 118, an inner surface 120 and an outer surface 122. The inner surface 120 of the collet 104 defines a longitudinal passage 124. The passage 124 defines a central axis P, referred to as the collet axis, and has an internal diameter A centered on the collet axis P that is sized to slidably receive the shank 38 of an accessory tool. The diameter A of the collet passage 124 is selected to receive one or more particular sizes or diameters of accessory tool shanks. The leading end portion 114 of the collet 104 defines a shank insertion opening 126 that leads into the passage 124. The shank 38 of an accessory tool is inserted through the shank insertion opening 126 and into the passage 124 when mounting an accessory tool onto the rotary tool 10.

At least one slot 128 is defined along a portion of the length of the collet 104. Each slot 128 begins at a rearward position that is spaced apart from the trailing end portion 118 of the collet 104 and extends through the leading end portion 114 of the collet 104. Each slot 128 extends through the outer surface 122 and the inner surface 120 of the collet 104 so as to divide the collet body into segments 130 that can be deflected radially inwardly to provide a clamping force on the shank 38 of an accessory tool received in the passage 124. As depicted in FIGS. 5-8, the collet 104 includes three slots 128 that divide the collet into three segments 130. In alternative embodiments, more or fewer slots may be utilized. As best seen in FIG. 6, each segment 130 of the collet 104 is defined collectively by a first lateral edge portion 132, a second lateral edge portion 134, and a leading edge portion 136.

The leading end portion 114 of each segment 130 of the collet 104 has a bell-shaped configuration that curves outwardly relative to the rest of the body of the collet 104 forming a radially outwardly projecting portion 138 at the end of each collet segment 130. The outward projecting portions 138

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of the collet segments **130** may be formed by simply bending the ends of the segments outwardly during the manufacturing process. As discussed below, the radially outwardly projecting portion **138** at the end of each segment **130** provides edges and surfaces that can be used to facilitate retention of the collet **104** within the collet chuck **108** and control the angular position of the collet **104** relative to the collet chuck **108** without obstructing the passage **124** and without requiring the incorporation of extra materials and/or complicated structures for accomplishing the same.

The collet **104** is formed of spring steel although the collet may be formed of other suitable materials, such as, for example, aluminum, zinc, injection molded plastics, glass-filled composites, carbon fiber composites, polycarbonates and/or the like. The collet **104** may be formed using any suitable process including, for example, stamping, bending, die casting, milling, turning, stock grinding, laser cutting, water jetting, injection molding, metal stamping and/or the like.

Referring to FIGS. 2-5 and 10-12, the collet chuck **108** is configured to releasably secure the collet **104** to the output shaft **34** of the motor **24** so that the shank **38** of the accessory tool **12** is aligned with the axis **M** of the output shaft **34** so the accessory tool **12** can be driven to rotate about the axis **M** by the motor **24**. As depicted in FIG. 11, the collet chuck **108** includes a generally cylindrical main body **152** having a collet receiving portion **154** and a mounting portion **156**. The collet receiving portion **154** and the mounting portion **156** of the collet chuck **108** may be manufactured from the same or different materials including, for example, steel, aluminum, zinc, injection molded plastics, glass-filled composites, carbon fiber composites, polycarbonates and/or the like.

The collet receiving portion **154** of the collet chuck **108** includes an inner surface **158** and an outer surface **160**. The inner surface **158** defines a collet receiving passage **162** configured to slidably receive the collet **104**. The passage **162** defines a longitudinal axis, referred to as the collet chuck axis **Q**, and has a diameter **B** centered on the axis **Q** that is selected to slidably receive the collet **104** with the collet axis **P** substantially aligned with the collet chuck axis **Q** (FIG. 10). The collet receiving portion **154** includes a leading or front end portion **164** that defines a collet insertion opening **166** leading into the passage **162**. The collet **104** is configured to be inserted into the passage **162** through the collet insertion opening **166** with the trailing end portion **118** of the collet **104** entering the passage **162** first.

The mounting portion **156** of the collet chuck **108** is configured to removably secure the collet chuck **108** to the output shaft **34** of the motor with the collet chuck axis **Q** aligned with the axis **M** of the output shaft **34**. In one embodiment, a bore **168** is defined in the mounting portion **156** that is configured to receive the distal end portion **36** of the output shaft **34**. The bore **168** may be provided with internal threads (not shown) for threaded engagement with external threads (not shown) provided on the distal end portion **36** of the output shaft **34**. Alternatively, other suitable methods of attaching the mounting portion of the collet chuck to the output shaft may be used such as press fit or snap fit engagement.

The collet chuck **108** includes at least one lever arm **170** that is configured to apply a clamping force radially inwardly onto the segments **130** of the collet **104** when the collet **104** is received in the passage **162** of the collet chuck **108**. A lever arm slot **172** is formed in the collet receiving portion **154** of the collet chuck **108** for each lever arm **170**. Each lever arm slot **172** extends through the outer surface **160** and the inner surface **158** to provide access to the passage **162** and the outer surface **122** of the collet **104** when the collet **104** is positioned

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in the passage **162**. As best seen in FIG. 5, three lever arm slots **172** are provided in the collet receiving portion **154** of the collet chuck **108** for receiving three lever arms **170**—one lever arm **170** for each segment **130** of the collet **104**.

Referring to FIG. 10, each lever arm **170** comprises a generally longitudinal body having a clamping portion **174**, an arm portion **176**, and a fulcrum point **F**. Each lever arm **170** is received in one of the lever arm slots **172** of the collet chuck **108** with the body arranged generally parallel to the collet chuck axis **Q**. As can be seen in FIG. 10, the lever arms **170** are arranged in the slot **172** with the clamping portion **174** oriented toward the leading end portion **164** of the collet chuck **108** and the arm portion **176** extending generally rearwardly toward the mounting portion **156** of the collet chuck.

Each lever arm **170** is secured to the collet receiving portion of the collet within the corresponding lever arm slot **172** for pivotal movement about the fulcrum point **F**. In one embodiment, each lever arm **170** is secured to the collet chuck **108** by a pin **178**. The pin **178** is received in a passage **180** that extends laterally through the main body of the lever arm **170** at the fulcrum point **F** to form trunnion-like projections on each side of the main body of the lever arm **170**. The end portions of the pin **178** are received in pin holes **182** defined in the side walls of the slots **172** in the collet receiving portion **154** of the collet chuck **108**.

Referring to FIGS. 5, 10, and 12, the clamping portion **174** of each lever arm **170** includes a collet engaging surface **184** that is arranged facing into the passage **162** defined in the collet receiving portion **154** of the collet chuck **108**. The collet engaging surface **184** is used to press against the outer surface **122** of the collet and apply a clamping force to the collet to secure the shank **38** of an accessory tool **12** within the collet **104**. The collet engaging surface **184** is arranged generally parallel to the collet chuck axis **Q** and may be provided with a curved contour as depicted in FIG. 12 to increase the amount of surface area of the collet **104** that can be contacted when applying the clamping force.

The arm portions **176** of the lever arms **170** extend rearwardly from the clamping portion **174** generally parallel to the collet chuck axis **Q**. In the embodiment of FIG. 10, the arm portions **176** extend along the body of the collet chuck **108** to position the tip portions **186** of the arm portions **176** adjacent to the cylindrical mounting portion **156** of the collet chuck **108**. In alternative embodiments, the mounting portion **156** may extend rearwardly for a lesser distance and/or the arm portions **176** may extend for a greater distance such that the tips **186** of the arm portions **176** are positioned adjacent the output shaft **34** of the motor **24**.

Referring to FIGS. 2-4 and 13-16, the lever arms **170** are configured to be manipulated by the wedge-shaped ring **110**, also referred to herein as the wedge. As best seen in FIGS. 13 and 14, the wedge-shaped ring **110** comprises a generally cylindrical body having a leading portion **188**, a trailing portion **190**, an inner surface **192**, and an outer surface **194**. The inner surface **192** defines a cylindrical passage **196**. The passage **196** has a diameter **C** that is sized to slidably receive the mounting portion **156** of the collet chuck **108** and/or output shaft **34** of the motor **24**. As depicted in FIG. 3, the wedge-shaped ring **110** is positioned on the mounting portion **156** of the collet chuck **108** between the motor **24** and the collet receiving portion **154** of the collet chuck **108** with the leading portion **188** of the wedge **110** oriented toward the collet chuck **108**.

The leading portion **188** of the wedge **110** includes a leading edge portion **198**. As can be seen in FIG. 14, the portion **195** of the outer surface **194** at the leading portion **188** of the wedge **110** tapers or slopes radially inwardly from a first outer

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diameter E proximate the trailing portion **190** of the wedge **110** to a second, smaller outer diameter F at the leading edge portion **198** of the wedge **110**. The tapering outer surface **195** of the leading portion forms a ramp surface that is used to manipulate the arm portions **176** of the lever arms **170**. The leading edge portion **198** of the wedge **110** has a width W that corresponds to the distance the leading edge portion **198** extends from the outer surface of the mounting portion **156** of the collet chuck **108**.

Referring to FIG. **10**, the tip portion **186** of each lever arm **170** is spaced apart from the mounting portion **156** of the collet chuck **108** to form a gap G. The gap G has a width that is slightly greater than the width W (FIG. **14**) of the leading edge portion **198** of the wedge-shaped ring **110** in order to allow the leading edge portion **198** to be advanced into the gap G between the tip portions **186** of the lever arms **170** and the outer surface of the mounting portion **156** of the collet chuck **108**. As the leading edge portion **198** of the wedge **110** is advanced into the gap G, the edge portion **198** and the ramp surface **195** engages the inner surface **202** (FIG. **10**) of the lever arms **170** to force the arm portions **176** of the lever arms **170** in a direction away from the mounting portion **156** of the collet chuck **108**. This action causes the lever arms **170** to pivot about the fulcrum points F and cause the clamping portions **174** of the lever arms **170** to move radially inwardly toward the central axis Q of the collet chuck **108** and apply a clamping force to the outer surface **122** of the collet **104** when the collet **104** is received in the passage **162** of the collet chuck **108**.

The wedge-shaped ring **110** is configured to move axially along the mounting portion **156** between a release position and a maximum clamping position. In the release position, the wedge-shaped ring **110** is positioned along the mounting portion **156** axially rearwardly of the collet receiving portion **154** of the collet chuck **108** so that the wedge **110** is spaced apart from the lever arms **170** of the collet chuck **108**. As a result, the lever arms **170** and the collet **104** are allowed to assume a relaxed state in which substantially no clamping force is being applied to the collet **104** by the lever arms **170**.

To apply a clamping force, the wedge-shaped ring **110** is advanced forwardly toward the collet chuck **108** from the release position until the leading edge portion **198** of the wedge **110** enters the gap G and the ramp surface **195** engages the inner surface **202** of the arm portions **176** of the lever arms **170**. The further the leading edge portion **198** and the ramp surface **195** are advanced under the arm portions **176** of the lever arms **170**, the further the arm portions **176** of the lever arms **170** ramp are forced away from the mounting portion **156** of the collet chuck **108** which increases the amount of clamping force being applied to the outer surface **122** of the collet **104** by the clamping portions **174** of the lever arms **170**.

Some type of stop mechanism may be utilized to prevent the forward movement of the wedge **110** past beyond a certain point so as not to cause damage to the lever arms or other components of the quick release assembly. In one embodiment, a wedge stop **204** (FIGS. **10** and **11**) is formed by a wall structure on the main body **152** of the collet chuck **108** that is oriented generally perpendicular to the collet chuck axis Q. In the embodiment of FIGS. **10** and **11**, the wall structure **204** defines the transition from the mounting portion **156** to the collet receiving portion **154** of the collet chuck **108**. In alternative embodiments, any suitable type of structure, including slots, detents, and the like, may be utilized to constrain the movement of the wedge-shaped ring **110** to within predetermined limits relative to the collet chuck **108**.

A biasing mechanism **206** is used to bias the wedge-shaped ring **110** forwardly toward the collet chuck **108** and into a

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clamping position. Referring to FIGS. **3**, **4**, and **16**, the biasing mechanism **206** comprises a coil spring that is located between the trailing portion **190** of the wedge-shaped ring **110** and the motor **24**. As depicted in FIG. **16**, the leading end portion **208** of the spring **206** is abutted against the trailing portion **190** of the wedge-shaped ring **110**. The trailing portion **190** of the wedge **110** includes a trailing surface **210** that provides a wall for engagement with the leading portion **208** of the spring **206**. The trailing end portion **212** of the spring **206** is abutted against a washer **214** held in position on the output shaft **34** of the motor **24** by a bearing **216**. The use of the biasing spring **206** enables the lever arms **170** to be moved radially outwardly from the body of the collet chuck with the aid of centrifugal force. As the collet chuck is driven to rotate, centrifugal forces may push the lever arms radially outwardly thereby providing clearance for the wedge-shaped ring **110** to be moved axially toward the collet chuck **108** by the spring **206**.

Although the collet **104** has been described as a separate component that is removable from the collet chuck, in an alternative embodiment, the collet **104** may be integrated into the collet chuck **108** so the collet and collet chuck are a single unit (not shown). In addition, it is possible that the collet chuck **108** can be used to secure an accessory tool to the rotary tool without the collet **104** by clamping directly onto the shank of the accessory tool.

A surface coating may be provided on one or more of the surfaces of the collet **104**, the collet chuck **108**, and the shank **38** of the accessory tool to enhance gripping strength and frictional engagement between the metal parts. In the embodiment described herein, the inner surface **120** of the collet **104** is provided with a coating or surface treatment to enhance the frictional engagement between the shank **38** of the accessory tool and the inner surface **120** of the collet to facilitate the retention of the shank within the collet **104** during use. In alternative embodiments, the collet engaging surface **184** of the collet chuck may be provided with a surface coating to enhance grip strength for gripping onto the outer surface **122** of the collet or onto the shank **38** of an accessory tool. Similarly, the outer surface **122** of the collet and/or the surface of the shank of the accessory tool may be provided with a surface coating to enhance gripping strength.

The surface coating has a microstructure that enhances the frictional properties of the surface onto it is deposited. The microstructure is the structure of the surface under a high degree of magnification, e.g., 25× to 1500×. In one embodiment, the inner surface **120** of the collet **104** is coated with a bonding material **140** which is shown more clearly in FIG. **9**. In alternative embodiments, the surface in FIG. **9** having the coating may comprise any one or more of the inner surface **120** of the collet **104**, the outer surface **122** of the collet **104**, the collet engaging surfaces **184** of the collet chuck **108**, and the shank **38** of the accessory tool. In one embodiment, the bonding material **140** comprises a nickel based bonding material. The microstructure deposited onto or within the bonding material includes abrasive particles **142**. The abrasive particles **142** are partially embedded within the bonding material **140** throughout the functional areas of the inner surface **120** in an electroless operation. The abrasive particles **142** in this embodiment are diamond particles with size selected from a range of about 20 to 50 microns. In a further embodiment, particles with a size between about 20-30 microns are used. This size abrasive is particularly well suited for providing improved grip strength.

The abrasive particles **142** include an embedded portion **148** and an extruding portion **150**. The amount of bonding material **140** that is applied to the inner surface **120** of the

collet **104** is controlled to generate the desired binding strength. In this embodiment, the amount of bonding material **140** is controlled to generate a protrusion of between about 30 percent and 55 percent for the abrasive particles **142** located on the cylindrically shaped collet **104**. Thus, while some of the abrasive particles **142** may not be within the desired range, most of the abrasive particles **142** will exhibit an extruding portion **150** that is between about 30 percent and 55 percent of the respective abrasive particle **142**.

In addition to controlling the amount of bonding material **140**, the amount of abrasive particles **142** may be controlled to provide the desired coverage. In the embodiment of FIG. 9, the abrasive particles **142** are bonded to the collet **104** at a concentration that results in an average spacing between adjacent abrasive particles **142** of 100 percent or a “full concentration.” That is, the distance between adjacent abrasive particles **142** is roughly equal to the sum of the radii of the two abrasive particles **142**.

Referring to FIG. 10, the collet chuck **108** includes a nose cap **218** that is removably attached to the leading portion **164** of the collet chuck **108**. The nose cap **218** includes a cylindrical body having an interior surface **220** that defines a hollow space **222** for receiving at least the leading portion **164** of the collet chuck **108**. The rear end portion **224** of the nose cap **218** is open to the hollow interior **222** to enable the leading portion **164** of the collet chuck **108** to be easily inserted into the nose cap **218**. The nose cap **218** includes a front wall portion **226** that is positioned in front of the leading portion **164** of the collet chuck **108** when the collet chuck **108** is received in the hollow space **222**. The front wall portion **226** of the nose cap **218** defines an opening **228** that leads into and is aligned with the collet insertion opening **166** and the passage **162** of the collet chuck **108** and couples the interior of the nose cap to the external environment.

The interior surface **220** of the nose cap **218** includes attachment features (not shown) that are configured to releasably attach the nose cap **218** to the collet chuck **108**. In one embodiment, the interior surface **220** of the nose cap **218** is configured for a press fit engagement with the outer surface of the leading portion of the collet chuck **108**. The nose cap **218**, however, may be removably attached to the collet chuck **108** in any suitable manner including, for example, threaded engagement and snap fit engagement.

The nose cap **218** is configured to allow the collet **104** to be inserted and removed from the collet chuck **108** while the nose cap **218** is attached to the collet chuck **108**. Similarly, the nose cap **218** is configured to allow the shank **38** of an accessory tool **12** to be inserted into and removed from the collet **104** when the collet **104** is positioned in the collet chuck **108** while the nose cap **218** is attached to the collet chuck **108**. As discussed below, the collet **104** and the nose cap **218** may be configured to cooperate so that the collet **104** is releasably retained within the passage **162** of the collet chuck **108** and/or to ensure that the collet **104** is positioned within the passage **162** of the collet chuck **108** with the collet segments **130** appropriately aligned with the lever arms **170** to promote optimal performance of the collet chuck **108**.

A user interface system is provided on the rotary tool to allow the user of the tool to manipulate the wedge-shaped ring **110** and control the clamping force applied by the collet chuck **108**. The user interface system includes a release mechanism **112** that is attached to the wedge-shaped ring **110** that enables a user to move the wedge-shaped ring **110** axially between the release position and the maximum clamping position. Referring to FIGS. 15-17, the release mechanism **112** includes a yoke member **230** and a bearing **232**. The yoke member **230** is accessible by the user of the rotary tool and is

configured to be moved axially by the user of the tool between a forward and a rearward position relative to the housing **12** of the rotary tool **10**. The bearing **232** is used to attach the yoke member **230** to the wedge-shaped ring **110** while decoupling the yoke member **230** from rotational movement of the wedge-shaped ring **110**. As the yoke member **230** is moved between the forward and rearward positions by the user, the wedge-shaped ring **110** is moved between the release position and the maximum clamping position in relation to the collet chuck **108**.

Referring to FIG. 17, the bearing **232** comprises a ball bearing or rolling element bearing having an inner surface **234** that defines an opening in which the trailing portion **190** of the wedge-shaped ring **110** is secured. As can be seen in FIGS. 13 and 14, the trailing portion **190** of the wedge-shaped ring has an outer surface **238** that defines an annular groove or recess **240** in which the inner surface **234** of the bearing **232** is retained. A snap ring **242** or similar type of structure may be used to prevent the removal of the bearing **232** from the groove **240** in the trailing portion **190** of the wedge-shaped ring **110**.

The yoke member **230** is attached to the outer surface **244** of the bearing **232**. Referring to FIG. 17, the yoke member **230** includes a ring-shaped body having an inner surface **248** that defines a passage **250** in which the bearing **232** is positioned. The outer surface **244** of the bearing **232** is secured to the inner surface **248** of the yoke member **230**. In one embodiment, the yoke member **230** is formed of plastic or polymeric material that is secured to the outer surface **244** of the bearing **232** by overmolding the yoke member **230** onto the bearing **232**. In this embodiment, the outer surface **244** of the bearing **232** is embedded into the inner surface **248** of the yoke member **230** as can be seen in FIG. 17. In alternative embodiments, the yoke member **230** may be secured to the outer surface **244** of the bearing **232** in any suitable manner including press fit or snap fit engagement, adhesives, and fasteners.

Referring to FIG. 15, the yoke member **230** includes at least one lever structure **252** that extends outwardly from the ring-shaped body **246**. The lever structures **252** provide a mechanism that can be easily accessed and manipulated by a user of the rotary tool **10** to move the wedge-shaped ring **110** and thereby control the clamping force applied by the collet chuck **108**. In the embodiment of FIGS. 15-17, two lever structures **252** are located on opposite sides of the ring-shaped body **246** of the yoke member **230**. Each lever structure **252** includes a knob portion **254** and a connecting portion **256**. The knob portion **254** has an ergonomic configuration that facilitates manipulation by a user. The connecting portion **256** connects the knob portion **254** to the body **246** and serves to offset the knob portion **254** of the lever structure **252** away from the body **246** of the yoke member **230** to a position near the exterior of the housing **12** of the rotary tool where the knob portion **254** can be accessed (See, e.g., FIG. 1).

A guide member **258** is configured to guide and facilitate the movement of the yoke member **230** along a linear path that is substantially parallel to the motor axis **M**. As depicted in FIG. 4, the guide member **258** comprises a housing having a disc-shaped central portion **260** that defines an opening **262** through which the mounting portion **156** of the collet chuck **108** and/or the output shaft **34** of the motor **24** extends. In one embodiment, the central portion **260** of the guide member **258** is held in a fixed axial position along the mounting portion/output shaft by the washer **214** and bearing **216** (FIGS. 16 and 17) described above in connection with the spring **206**. In alternative embodiments, the guide member **258** can be held in a fixed axial position relative to the output shaft in any suitable manner.

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A pair of bracket structures **264** extends from the central portion **260** on opposite sides of the opening **262**. When positioned on the mounting portion/output shaft, the bracket structures **264** are arranged substantially parallel to the axis M. Each bracket structure **264** includes a pair of arms **266** that define a slot **268** therebetween through which the connecting portion **256** of one of the lever structures **252** extends. The bracket structures **264** position the slots **268** substantially parallel to the axis M in order to guide the movement of the connecting portions **256** as the yoke member **230** is moved between the release position and the maximum clamping position by the knobs **254**. Each slot **268** has a width that is greater than the width of the connecting portion and less than the width of the knob portion of the corresponding lever. As a result, the knob portions **254** of the lever structures **252** are positioned adjacent to the outer surfaces **270** of the bracket structures **264**. The bracket structures **264** therefore also help maintain the knob portions **254** equidistant from the axis M so that skewing of the yoke member **230** relative to the mounting portion **156** is prevented.

As depicted in FIG. 1, the connecting portions **256** of the lever structures **252** extend through slots **272** defined in the housing **14** to position the knob portions **254** of the lever structures **252** at accessible positions exterior to the housing **14**. The slots **272** provide clearance for the knob portions **254** and connecting portions **256** to be moved by a user between the forward and rearward position. The forward position corresponds to the maximum clamping position, and the rearward position corresponds to the release position. Because the knob portions **254** are connected to the wedge-shaped ring **110** (via the connecting portions, yoke member, and bearing), the positions of the knob portions **254** in relation to the slots **272** provide a visual indication of the state of the clamping force being applied by the collet chuck **108** that can easily be identified by a user.

During use, the wedge-shaped ring **110** is configured to rotate along with the collet chuck **108** when the wedge-shaped ring **110** is positioned in engagement with the lever arms **170** of the collet chuck **108**. The bearing **232** decouples the yoke member **230** and the lever structures **252** from the rotational movement of the wedge **110** which enables the yoke member **230** and the lever structures **252** to remain substantially stationary while the wedge-shaped ring **110** is being rotated by the collet chuck **108**. By decoupling the yoke member **230** from the rotational movement of the wedge-shaped ring **110**, damage to the wedge-shaped ring **110**, the yoke member **230**, and the lever structures **252** can be avoided in case the yoke member **230** is inadvertently moved while the collet chuck **108** is rotating.

The quick change assembly **100** enables the clamping force to be applied and removed from the collet **104** in a fast and convenient manner, and also enables the collet **104** to be easily installed and removed from the rotary tool **10** without requiring the removal of a separate retaining device, such as a collet nut or nose cap. One challenge in utilizing a removable collet is retaining the collet **104** within the collet chuck **108** during use and when the shank of an accessory tool is being inserted into and removed from the collet.

As noted above, the collet **104** and nose cap **218** may be configured to cooperate to releasably retain the collet **104** within the passage **162** of the collet chuck **108**. Referring to FIGS. 18-20, an embodiment of a nose cap **280** configured to releasably retain the collet **104** within the passage **162** of the collet chuck **108** is depicted. The nose cap **280** is configured to utilize the outwardly projecting portions **138** of the collet **104** to provide a collet retention feature that enables the collet **104** to be inserted into, retained in, and removed from the

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collet chuck **108** without requiring the use of a separate tool or a complicated retention system.

The front wall portion **282** of the nose cap **280** defines an opening **284** having a keyed shape that generally matches the peripheral shape of the collet **104** (as seen in the end view of FIG. 8). In particular, the front wall portion **282** of the nose cap **280** defines an opening **284** having a central portion **286** and three radial portions **288** that are evenly spaced about the central portion **286**. The central portion **286** is configured to receive the cylindrical body portion of the collet **104** and therefore has a width dimension, or diameter H that is slightly larger than the outer diameter J (FIG. 7) of the cylindrical body of the collet **104**. Once past the keyed opening **284** of the front wall portion **282** of the nose cap, the nose cap widens into the hollow space **290** for receiving the leading portion **164** of the collet chuck **108**.

The radial portions **288** of the opening **284** are sized and positioned complementary to the outwardly projecting portions **138** of the collet segments **130**. Each radial portion **288** of the opening **284** is defined by a first lateral edge portion **290**, a second lateral edge portion **292**, and a radially outer edge portion **294** that extends between the first and second lateral edge portions **290**, **292**. Each radial portion **288** of the opening **284** has a length dimension R that corresponds to the length of the lateral edge portions **290**, **292** and a width dimension S that corresponds to the distance between the first and second lateral edge portions **290**, **292**. The length dimension R of the radial portions **288** is at least slightly greater than the distance T that the leading edge portion **136** of the collet segments is projected outwardly from the main cylindrical body of the collet **104** (FIG. 7). The width dimension of each radial portion **288** is slightly greater than the width dimension U of the outwardly projecting portions **138** of the collet segments between the lateral edges **132**, **134** (FIG. 8).

To provide a collet retention feature in the nose cap **280**, at least one detent structure **296** is provided in the front wall portion **282** of the nose cap **280** that projects into at least one of the radial portions **288** of the opening **284**. The detent structure **296** alters the shape of the radial portion **288** of the opening **284** so that the insertion and removal of the collet **104** is prevented while the collet **104** is in a relaxed state, i.e., the collet segments **130** are not being deflected. The radially outwardly projecting portions **138** of the collet **104** provide a complementary detent structure that cooperates with the detent structure **296** of the nose cap **280** to provide the blocking feature.

In the embodiment of FIGS. 18-20, the detent structure **296** in the nose cap comprises a pair of projections that extend partially across the width S of one of the radial portions **288** of the opening **284** in the nose cap **280**. The pair of projections **296** thus cause a portion of the width S of the corresponding radial portion **288** of the opening **284** to be less than the width U of the outwardly projecting portions **138** of the collet **104** as depicted in FIG. 19. The projections **296** may be formed during the manufacturing of the nose cap by using an insert (not shown) in mold tooling (not shown). A slot **302** formed in the front wall portion **282** of the nose cap **280** may be used to facilitate the removal of the insert from the tooling when the mold is completed. Therefore, a nose cap **280** with the detent structures **296** may be formed without a significant increase in the complexity and cost of manufacturing the nose cap.

In order to install the collet **104** into the collet chuck **108** with the nose cap **280** attached thereon, the trailing end portion **118** of the collet **104** is inserted into the central portion **286** of the opening **284** in the nose cap **280**. The collet **104** is then advanced through the opening **284** and through the collet insertion opening **166** of the collet chuck **108** and into the

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passage 162 of the collet chuck 108. The collet 104 is advanced into the passage 162 of the collet chuck until the outwardly projecting portions 138 of the collet 104 are near the front wall portion 282 of the nose cap 280. The detent structures 298 are positioned in the path of movement of at least one of the outwardly projecting portions 138 of the collet 104 and therefore prevent further movement of the collet 104 into the collet chuck 108 while the collet is in a relaxed state.

In order to move the collet past the detent structures 298 in the nose cap 280, the segment 130 of the collet 104 that is adjacent to the detent structures 298 is deflected radially inwardly toward the collet axis P which moves the outwardly projecting portion 138 of the collet segment 130 out of the way of the detent structures 298 so the collet 104 can be advanced through the opening 284 in the nose cap 280 and further into the passage 162 of collet chuck 108 as depicted in FIG. 20. Once the outwardly projecting portion 138 of deflected segment 130 of the collet 104 is advanced past the detent structures 198 and the front wall portion 282, the segment 130 is allowed to deflect outwardly and snap back into its normal, relaxed position.

Once the collet 104 is seated in the collet chuck 108 and returned to a relaxed state, the detent structure 296 is positioned to block the movement of the collet 104 out of the passage 162 of the collet chuck while the collet is in a relaxed state as depicted in FIG. 19. Therefore, the collet 104 can be retained in the collet chuck 108 when the shank 38 of an accessory tool is inserted into and removed from the collet 104. The detent structure 296 is also configured to block movement of the collet 104 out of the collet chuck 108 while the collet is clamping onto the shank 38 of an accessory tool in the collet chuck 108. When a clamping force is applied to the collet 104 by the collet chuck 108, the ends of the segments 130 may be deflected slightly inwardly. The detent structures are configured to block the movement of the collet 104 out of the collet chuck 108 while the collet is in a relaxed state and while the collet is clamping onto the shank 38 of an accessory tool.

The curved outer surface 304 (FIG. 7) of the outwardly projecting portions 138 of the collet segments 130 enable the collet segment 130 adjacent to the detent structure 296 to be deflected by simply pressing the collet axially into the passage 162 of the collet chuck 108. As the collet 104 is advanced into the passage 162 of the collet chuck 108, the detent structure 296 engages the curved surface 304 of the nearby collet segment 130 and deflects the segment 130 inwardly until the leading edge portion 136 of the segment 130 moves past the detent structure 296, at which point the segment 130 is allowed to snap back into a relaxed state.

To remove the collet 104 from the collet chuck 108 and nose cap 280, the user deflects the segment 130 of the collet 104 adjacent to the detent structure 296 inwardly until the segment 130 is clear of the detent structure 296 and then withdraws the collet 104 from the collet chuck 108 as depicted in FIG. 20. The detent structure 296 on the nose cap 280 and the outwardly projecting portions 138 of the collet segments thus cooperate to enable the collet 104 to be easily installed and removed from the collet chuck 108 without requiring a separate tool or complicated mechanism, retain the collet 104 within the collet chuck 108 while the collet 104 is in a relaxed state so the shank of an accessory tool can be installed and removed from the collet, and retain the collet 104 within the collet chuck 108 while the shank 38 of an accessory tool 12 is being clamped by the collet 104 to prevent the inadvertent withdrawal of the collet 104 from the collet chuck 108 during use.

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In alternative embodiments, the detent structure may be provided in a variety of shapes and configurations and in other locations relative to the opening 284 in the nose cap 280 and still provide the same functionality as the embodiment described above. For example, in one alternative embodiment, a single projection may be provided along one side of the radial portion of the opening. In another alternative embodiment, the detent structure may be formed at the radial outer edge of the radial portion of the opening to cause the length of the radial portion of the opening to be slightly less than the distance that the leading edge portion of the collet segments projects outwardly from the main cylindrical body of the collet.

Another important consideration in utilizing a user removable collet as disclosed herein is the angular orientation or position of the collet 104 with respect to the collet chuck 108. To facilitate proper performance of the collet chuck 108, the segments 130 of the collet 104 should be aligned with the lever arms 170 so that the segments 130 can be deflected properly by the lever arms 170 when a clamping force is applied. Referring to FIGS. 21-24, an embodiment of a nose cap 310 is depicted that is configured to use the outwardly projecting portions 138 of the collet 104 to provide an anti-rotation, or clocking, feature that enables the collet 104 to be inserted into the passage 162 of the collet chuck 108 at a predetermined angular orientation and held at this orientation during use.

The nose cap 310 includes a front wall portion 312 that defines an opening 314 having a keyed shape that generally matches the peripheral shape of the collet 104 (as seen in the end view of FIG. 8). In particular, the front wall portion 312 of the nose cap 310 defines an opening 314 having a central portion 316 and three radial portions 318 that are evenly spaced about the central portion 316. The central portion 316 is configured to receive the cylindrical body portion of the collet 104 and therefore has a width dimension or diameter H that is slightly larger than the outer diameter J of the cylindrical body of the collet 104.

The radial portions 318 of the opening 314 are sized and positioned complementary to the outwardly projecting portions 138 of the collet segments 130. Each radial portion of the opening is defined by a first lateral edge portion 320, a second lateral edge portion 322, and a radially outer edge portion 344 that extend between the first and second lateral edge portions 320, 322. Each radial portion 318 of the opening 314 has a length dimension R that corresponds to the length of the lateral edge portions 320, 322 and a width dimension S that corresponds to the distance between the first and second lateral edge portions 320, 322. The length dimension R of the radial portions 318 of the opening 314 is at least slightly greater than the distance T that the leading edge portion 136 of the collet segments 130 is projected outwardly from the main cylindrical body of the collet 104 (FIG. 7). The width dimension S of each radial portion 318 is slightly greater than the width dimension U of the outwardly projecting portions 138 of the collet segments 130 between the lateral edges 134, 136 (FIG. 8).

The central portion 316 of the opening 314 extends through the nose cap 310 to permit passage of the cylindrical body of the collet 104 through the nose cap 310, through the collet insertion opening 166 of the collet chuck 108, and into the passage 162 defined by the collet chuck 108. The radial portions 318 of the opening 314 in the nose cap 310 lead into radial slots or recesses 350 that extend axially for a distance into the nose cap 310. The radial slots 350 are aligned substantially with the lever arms 170 of the collet chuck 108 so

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that the collet segments **130** are positioned properly with respect to the lever arms **170** when the collet **104** installed in the collet chuck **108**.

Each radial slot **350** is defined by a first lateral surface **352**, a second lateral surface **354**, and an axially rearward surface or bottom surface **358**. In the embodiment of FIGS. **21-24**, the bottom surface **358** is recessed from the front wall portion **312** and the first and second lateral surfaces **352**, **354** are oriented generally parallel to the longitudinal axis of the nose cap extending between the bottom surface **358** and the front surface **312**.

To install the collet **104** into the collet chuck **108**, the trailing end portion **118** of the collet **104** is inserted into the central portion **316** of the opening **314** in the nose cap **310**. The collet **104** is then advanced through the opening **314** in the nose cap **310**, then through the collet insertion opening **166** of the collet chuck **108** and into the passage **162** of the collet chuck **108**. The collet **104** is advanced into the passage **162** of the collet chuck **108** until the outwardly projecting portions **138** of the collet **104** are near the front wall portion **312** of the nose cap **310**. The collet **104** is then rotated until the outwardly projecting portions **138** of the collet **108** are aligned with the radial portions **318** of the opening **314**. The outwardly projecting portions **138** of the collet **104** are then advanced through the radial portions **318** of the opening **314** and into the radial slots **350**. The bottom surface **358** in the radial slots **350** prevents the outwardly projecting portions **138** of the collet segments **130** from being advanced past the radial slots **350** in the nose cap **310**.

The outwardly projecting portions **138** of the collet segments each include a first lateral edge portion **364** and a second lateral edge portion **366** that correspond to the portions of the lateral edges of the segments **130** that project radially outward from the body of the collet **104**. When positioned in the radial slots **350**, the first lateral edge portion **364** is positioned adjacent to and facing the first lateral surface **352** of the slot **350**, and the second lateral edge portion **366** is positioned adjacent to and facing the second lateral surface **354** of the slot **350**. The first and second lateral surfaces **352**, **354** of the slots **350** bracket the outwardly projecting portions **138** of the collet segments **130** and thereby prevent rotational movement of the collet **104** with respect to the nose cap **310**.

The nose caps described above are each configured to perform a task that facilitates the use of a user removable collet in a quick change assembly of a rotary tool. Although the features may be provided in different nose caps as described above, the collet retention features and the collet anti-rotation features of the nose caps described above may be combined into a single nose cap that is configured to releasably retain as well as angularly position the collet with respect to the collet chuck when the collet is installed in the collet chuck.

While the disclosure has been illustrated and described in detail in the drawings and foregoing description, the same should be considered as illustrative and not restrictive in character. It is understood that only the preferred embodiments have been presented and that all changes, modifications and further applications that come within the spirit of the disclosure are desired to be protected.

What is claimed is:

1. A rotary tool comprising:

a housing defining at least one slot; a motor including an output shaft supported within the housing;

a collet chuck coupled to the output shaft, the collet chuck including a main body defining a collet receiving passage configured to slidably receive a collet, the collet chuck including at least one lever arm pivotably attached

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to the main body and configured to apply a clamping force to the collet when the collet is received in the collet receiving passage;

a wedge configured to move into engagement with the at least one lever arm to generate the clamping force and to move out of engagement with the at least one lever arm to remove the clamping force;

a bearing attached to the wedge; and

a yoke member attached to the bearing such that the yoke member and the wedge are rotatable with respect to each other, the yoke member including at least one lever structure that projects outwardly from the yoke member through the slot, the lever structure being movable between a first position and a second position, the wedge being moved into engagement with the at least one lever arm when the lever structure is moved to the first position and the wedge being moved out of engagement with the at least one lever arm when the lever structure is moved to the second position.

2. The rotary tool of claim 1, wherein the wedge defines an opening through which the output shaft extends, the wedge being configured to slide axially along the output shaft.

3. The rotary tool of claim 2, wherein the bearing comprises a ball bearing having an inner surface and an outer surface.

4. The rotary tool of claim 2, wherein the wedge includes an outer surface that defines an annular groove in which the inner surface of the bearing is received.

5. The rotary tool of claim 4, wherein the yoke member is attached to the outer surface of the bearing.

6. The rotary tool of claim 5, wherein the yoke member is overmolded onto the outer surface of the bearing.

7. The rotary tool of claim 1, wherein the at least one lever structure comprises a pair of lever structures that extend outwardly from the yoke member on opposites of the yoke member.

8. The rotary tool of claim 7, wherein each lever structure includes a knob portion and a connecting portion, the connecting portion being interposed between the knob portion and the yoke member, and wherein the connecting portion extends through the at least one slot of the housing to position the knob portion exterior to the housing.

9. The rotary tool of claim 8, further comprising: a guide member supported in the housing, the guide member including a pair of bracket structures, each bracket structure defining a slot arranged substantially parallel to a longitudinal axis of the output shaft, wherein the connecting portions of the lever structure extend through the slots.

10. The rotary tool of claim 1, further comprising a biasing mechanism that biases the wedge into engagement with the at least one lever arm.

11. A quick change assembly for a rotary tool comprising:

a collet chuck configured to couple to an output shaft of a motor of a rotary tool, the collet chuck including a main body defining a collet receiving passage configured to slidably receive a collet, the collet chuck including at least one lever arm pivotably attached to the main body and configured to apply a clamping force to the collet when the collet is received in the collet receiving passage;

a wedge configured to move into engagement with the at least one lever arm to generate the clamping force and to move out of engagement with the at least one lever arm to remove the clamping force;

a bearing attached to the wedge; and

a yoke member attached to the bearing such that the yoke member and the wedge are rotatable with respect to each

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other, the yoke member including at least one lever structure that projects outwardly from the yoke member through a slot in a housing of the collet chuck, the lever structure being movable between a first position and a second position, the wedge being moved into engagement with the at least one lever arm when the lever structure is moved to the first position and the wedge being moved out of engagement with the at least one lever arm when the lever structure is moved to the second position.

12. The assembly of claim 11, wherein the bearing comprises a ball bearing having an inner surface and an outer surface.

13. The assembly of claim 12, wherein the wedge includes an outer surface that defines an annular groove in which the inner surface of the bearing is received.

14. The assembly tool of claim 13, wherein the yoke member is attached to the outer surface of the bearing.

15. The assembly tool of claim 14, wherein the yoke member is overmolded onto the outer surface of the bearing.

16. A rotary tool comprising:
an accessory tool attachment system including a leading portion and a trailing portion; and a user interface system

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attached to the attachment system, the user interface system including a release mechanism defining a yoke member configured to move axially between a first position and a second position and a bearing configured to decouple the yoke member from rotational movement of the accessory tool attachment system,

wherein the accessory tool attachment system including: a collet chuck coupled to a collet at the leading portion and to a output motor shaft at the trailing portion, the collet chuck including a body defining a passage communicatively coupled the leading portion to the trailing portion, an outer surface, and at least one lever arm pivotably attached to the outer surface and configured to apply a clamping force to the collet when the collet is received in the passage.

17. The rotary tool of claim 16, further comprising a wedge configured to move into engagement with the at least one lever arm at the first position and to move out of engagement with the at least one lever arm at the second position.

18. The rotary tool of claim 17, wherein the wedge is integrated as part of the user interface system.

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